THE ESSENTIAL ABOUT ALFALFA

Technical guide
for successful growing

A BRAND OF
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Contents

GENERAL

Where does alfalfa come from?

Why is alfalfa a crop of the future?

WHERE DOES ALFALFA COME FROM?

Alfalfa, the oldest forage crop

Alfalfa comes from Asia minor where it was identified almost 10,000 years ago. At the time, it was considered as a forage crop that was **easy to grow and store,** which explains its rapid spread, firstly in Mediterranean Europe, East Africa, followed by North Africa.

Nowadays, alfalfa covers almost **32 million hectares worldwide.** It is mainly developed in temperate zones: **Europe, North America, Japan, the southern tips of Africa and America, Australia, the temperate zones of China.**

Alfalfa in the vegetative phase

The origin of the different alfalfa populations

All the varieties of alfalfa registered in Europe come from the **hybridisation of two botanical species: Medicago Sativa and Medicago Falcata.**

Medicago Sativa originally comes from the Lebanese plains. With its deep taproot, it has **good tolerance to** summer droughts. It is characterised by its purple flowers.

Medicago Falcata originally comes from Siberia. It is a hardy species, **very cold-resistant**, but **less productive** than Medicago Sativa. It is characterised by yellow flowers and branched-out roots.

The importance of the genetic presence of either of the two species determines the soil and weather niche to which the selected variety is adapted.

Alfalfa in the initiation phase

WHY IS ALFALFA A CROP OF THE FUTURE?

Alfalfa **is one of the most broadly cultivated leguminous forage crops in the world.** Its popularity has however declined since the 1960s with the arrival on the market of synthetic nitrogen-enhanced fertilisers. At the same time, the increase in work rate, due to mechanised harvesting has promoted the development of maize and grasses to the detriment of alfalfa.

However, **in the currently changing agricultural world,** alfalfa is currently the focus of renewed interest due to its many advantages:

Alfalfa at the start of flowering

Economic benefits

Alfalfa gives better protein autonomy in a context where the price of cattle meal (soya, rapeseed, sunflower) is fluctuating. **Alfalfa is the species that produces most protein per hectare,** on average, 2.5 T/ha, i.e. more than three times that of soya. **Alfalfa, when grown with forage maize, is the best combination for forage autonomy of dairy herds.**

Agronomic benefits

As part of a crop rotation programme, alfalfa restructures **and ventilates the soil in-depth** thanks to its powerful taproot that can grow down to 2 metres and **restores up to100 kg/ha of nitrogen to the soil** for the following crop.

Environmental benefits

The environmental assets of alfalfa are now well established:

- Improvement of the **structure** and **fertility of soil**
- Preservation of **water quality**
- Modification of **weeds**
- Low **greenhouse gas** (N_2O) emissions
- Hosting of **animal biodiversity.**

They help give alfalfa the place it deserves in agricultural systems.

Key facts

THE 5 STRENGTHS OF ALFALFA

- PROTEIN: The leader in protein/hectare production
- FIBRE DIGESTIBILITY: Contributes to excellent digestion and functioning of the rumen
- PRODUCTIVITY: Very productive forage and very hardy in the summer
- PERSISTENCE: 3 to 5 years
- NITROGEN AUTONOMY: Reduces costs

Notes

THE PHYSIOLOGY OF ALFALFA

Source: internal to MAS Seeds

What is the principle of dormancy?

How does alfalfa-rhizobium symbiosis work?

What can be combined with alfalfa?

What are the key growing phases?

WHAT IS THE PRINCIPLE OF DORMANCY?

The main criterion of varietal choice, dormancy **defines the duration during which alfalfa stops its development activities during the winter.** Dormancy is scored on a scale of 1 to 12: Dormancy 1 varieties are in dormancy for more than 10 months in the year whereas dormancy 12 varieties grow continuously. Usually, **the dormancy number corresponds to the number of times in the year** the crop is mowed, when the variety is grown in the right environment.

Dormancy 2 to 5: Flemish alfalfa

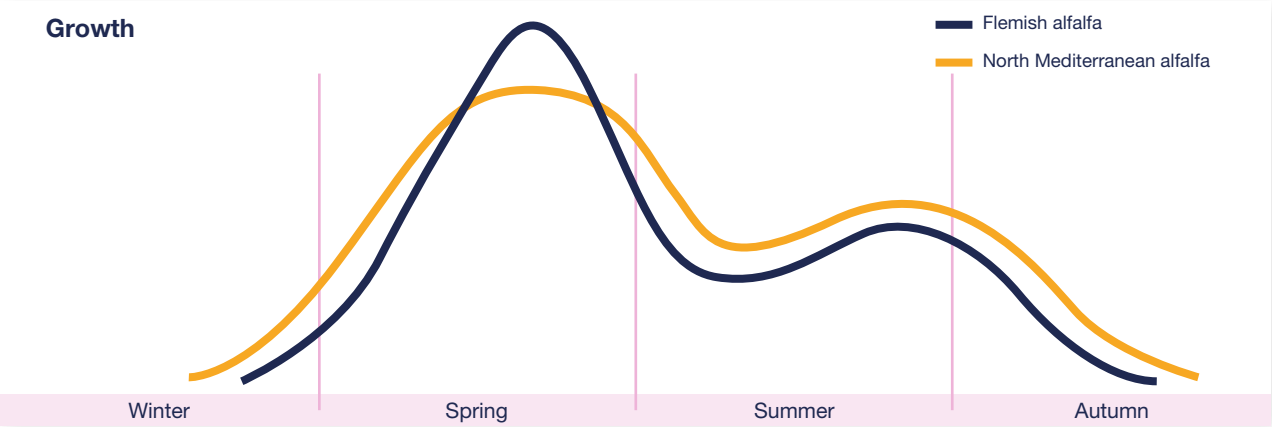
- Flemish alfalfa **shows excellent production on the two first cuts of the year**. However, **it has difficulty coping with frequent mowing** and production declines with the number of cuts it is mowed.
- Inversely, the quality of alfalfa increases with the number of cuts it is mowed:
  The last cut in the year produces **the most protein.**
- Ideal for the regions of Northern Europe, dormancy 2 to 5 alfalfa shows good **tolerance to the cold.**
  Dormancy 2 to 3 alfalfa is mainly grown **in northern Russia**, and in the Baltic countries. Dormancy 4 to 5 alfalfa is grown **throughout Western Europe, Central Europe, Eastern Europe** and the mountainous areas of Southern Europe.

Alfalfa in the vegetative phase

Dormancy 6 to 12: north Mediterranean alfalfa

- Unlike Flemish alfalfa, Mediterranean alfalfa **easily copes with frequent mowing** and grows back well after each cut. Production is regular throughout the year. Mediterranean alfalfa can reach **very high production levels** and may be mown 6 to 12 times a year. To maintain this high level of performance, it is important to check potassium inputs.
- Dormancy 6 to 7 alfalfa **behaves well in drought conditions.** However, Dormancy 8 to 12 alfalfa is very sensitive to water stress and requires perfect irrigation.
- Dormancy 6 to 7 alfalfa is mainly **grown in southern Europe, around the Mediterranean.** Dormancy 8 to 12 alfalfa is mainly cultivated in North Africa and southern Spain and Italy.

WHAT IS THE PRINCIPLE OF DORMANCY?



Source: internal to MAS Seeds

Key facts

DORMANCY2-5

- Peak production in the spring
- Cannot cope with frequent mowing rhythms
- Good tolerance to the cold

DORMANCY 6-12

- More regular production over the year
- Can cope with frequent mowing
- Good resistance to drought

HOW DOES ALFALFA-RHIZOBIUM SYMBIOSIS WORK?

Like all leguminous plants, alfalfa **can trap nitrogen present in the atmosphere** thanks to its **symbiotic activity** with bacteria in the **rhizobium** family.

How alfalfa-rhizobium symbiosis works

- **Rhizobiums colonise the roots** of alfalfa for the first month and a half after germination. **They develop in nodules** around the main root.
- Rapid and effective symbiosis allows good establishment of the crop and **improves productivity, quality and persistence of the alfalfa.**
- Alfalfa provides the energy needed for the bacteria's metabolism. In exchange, **the rhizobiums trap nitrogen in the air and restore it to the alfalfa** in the form of ammoniac which may be assimilated by the plant.
- In the case of good symbiosis, **there are few, large and pink-coloured nodules.** Inversely, a large number of small grey nodules is a sign of quite ineffective symbiosis.
- The nitrogen trapped can represent **up to 300 kg of nitrogen per ha.**

Observation of nodules 6 weeks after emergence

Pre-inoculation

- **Rhizobium** bacteria **are very sensitive to their environment** (acidity of the soil, temperature differences, luminosity, hydromorphic quality and compaction of soil) which makes it **very difficult** to naturally maintain populations of rhizobiums in the soil.
- **Pre-inoculation** allows **fast and effective colonisation of the roots** by rhizobium bacteria as soon as the alfalfa emerges. It is particularly recommended to use inoculated seeds **in acid soil** and on plots where there have been no alfalfa crops for more than 10 years.
- It is possible to determine the quality of pre-inoculation about 1 month after emergence by **observing the development of the nodules** and the vegetative parts of the alfalfa.

	Good symbiosis between roots and bacteria	Poor symbiosis between roots and bacteria
Plant	Dark green Many leaves Good emergence	Pale green Sparse foliage Slow growth
Nodules	Large Pink Few of them Grouped around the taproot	Small Grey/white Many of them Disseminated on the small roots

Source: Arvalis

Micronutrition

- Although it is very resistant once in position,**alfalfa is difficult to establish,** especially in times of drought.
- **Micronutrition** accompanies alfalfa during this critical phase. It improves **the population** and strengthens **the starting vigour** of seedlings.

SAS GOLD seed coating

- SAS GOLD seed coating combines **pre-inoculation and micronutrition.**
- It helps improve the **density**, **productivity** and **persistence** of the alfalfa crop.

Root volume on emergence with or without SAS GOLD treatment

SAS GOLD coating

PRE-INOCULATION + MICRONUTRITION

BETTER ESTABLISHMENT

- 15% more plants/ha
- Stronger seedlings
- Better root development

BETTER PERFORMANCE

- 6% more protein
- 12% more yield on the first mows

WHAT CAN BE COMBINED WITH ALFALFA?

Combinations of alfalfa

- Each **variety of alfalfa** has **its own ecological niche** in which it can express 100% of its genetic potential.
- The varieties have **different levels of sensitivity** to various diseases, cold, water stress, lodging and all types of environmental stress.
- **As weather conditions** and **environmental stresses** can vary greatly year on year, sowing a mixture of varieties **is a means of securing the production of the alfalfa crop** for its duration.

Alfalfa in the flowering phase

Plot of Galaxie Max

Combination example

THE GALAXIE MAX MIX HAS BEEN DEVELOPED TO SECURE YIELD IN ALL CONDITIONS

- GALAXIE gives the mixture volume, protein content and good disease tolerance
- TIMBALE gives hardiness and better digestibility

Multi-species mixes

Alfalfa is often cultivated in combination with other forage species, grasses or leguminous crops.

There are many advantages to these multi-species mixes:

- Better **cover of heterogeneous soil**
- **Regular production** over the year
- **fertiliser savings**
- Modulation of **the nutritional value of the harvested forage**
- Reduction of the **risk of soiling**

Multi-species grass and leguminous mix

The choice of species to be included in the mix must be determined according to:

- **The use of the pasture**
- The objective **of duration of the pasture**
- **The type of soil**
- **The growth dynamic of the species**

The growth dynamic of the species is a very important criterion **to avoid competition** when the species emerge. Alfalfa, which has a very slow growth dynamic, goes very well with tall fescue or white clover for example.

Behaviour of mixed species

9= rapid/ strong 1= slow/weak	Speed of installation	Competition power in the spring	Summer growth	Productivity after 3 years
Hybrid ryegrass	9	9	1	1
English ryegrass	8	3-7	1	3
Orchard grass	5	8	8	9
Tall fescue	3	7	8	9
Meadown fescue	3	4	5	3-5
Timothy	1	3-4	4	5
White clover	5	3-4	3-4	4-6
Red clover	7	6	6	1
Alfalfa	4	3-6	9	7

Source: Arvalis

WHAT ARE THE KEY GROWING PHASES?

The alfalfa cycle

- A multiannual species, alfalfa **is planted for 3 to 6 years.**
- In **the first year**, the aim is to **ensure good establishment** of the crop so that the root system develops sufficiently before the first winter.
- **Alfalfa becomes dormant at the end of the autumn and re-emerges in the spring** with the warmer weather. In a given environment, Mediterranean type alfalfa becomes dormant 10 to 15 days before Flemish alfalfa.
- From the **second year**, the objective is to**ensure productivity of alfalfa while maintaining its persistence**.
- **Alfalfa arrives at the mowing stage** (start of budding to the start of flowering) 1 to 2 months after re-emergence. **Each time it is cut, alfalfa creates new stems** that need to be mown 3 to 5 weeks later.
- **Every winter, alfalfa becomes dormant** in the first weeks of cold weather until the following spring.

Grow-back of alfalfa 15 days after mowing

WHAT ARE THE KEY GROWING PHASES?

Key phases

Phase	Vegetative	Initiation	Start of budding	Budding	Start of flowering	Flowering
Description	Total lack of floral buds	The floral bud can be felt under the fingers at the tips of the stems (50% of stems)	Inflorescence visible compact (50% of stems)	Inflorescence visible compact (75% of stems)	Appearance of a purple edging on the inflorescence (50% of stems)	Blossomed flowers (75% of stems)

Key phases

- **The 3 trefoil phase**
  This is the stage when the alfalfa seedling is considered to be effectively established. Alfalfa is sufficiently robust to cope with various treatments

- **The start of budding phase**

  This is the optimal harvesting stage to achieve good quality (protein, digestibility). It is recommended to mow at this stage if looking for a good yield/protein rate compromise.

- **The start of flowering phase**
  This is the optimal harvesting stage to achieve good dry matter yield. It is recommended to mow at this stage if looking to produce high quality hay.

Source: internal to MAS Seeds

Notes

GROWING ALFALFA

Source: internal to MAS Seeds

Sowing alfalfa: When and how?

Fertilising alfalfa

Controlling weeds

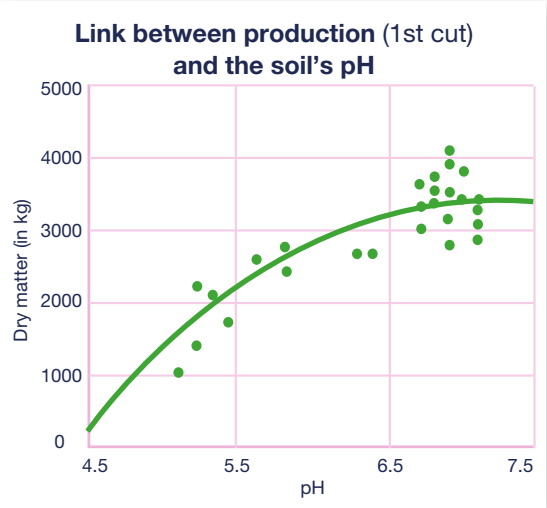
Harvesting alfalfa

SOWING ALFALFA: WHEN AND HOW?

Although alfalfa is very robust once installed, its establishment is a critical phase in the success of the crop. **The aim in the first year is to ensure an even and dense start to the crop** throughout the whole plot of land and to **ensure a sufficiently developed root system** to guarantee the persistence of the alfalfa.

Choosing the right plot

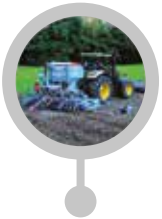
- Growing alfalfa **requires healthy and aerated soil** to promote the development of the nodules and gas exchanges in the roots.
- **Hydromorphic or** excessively compact soil asphyxiates the bacteria and prevents the development of nodules.
- Also, excessively an acidic pH inhibits the activity of symbiotic bacteria. Symbiotic activity is optimal with **a slightly acidic to neutral pH**.
- Finally, as alfalfa is an auto-toxic species, it is important to keep to a **5 to 7 year rotation** between the sowing of two alfalfa crops on the same plot.



Source: Arvalis

Preparing the soil well

- The **seed bed** must be sufficiently **fine and crumbly** on the surface to facilitate root growth.
- As alfalfa seeds are very fine, the soil must be sufficiently **pressed back in depth** and it is recommended to **roll the soil before and after sowing** to increase contact between the seed and soil particles.
- **The ideal depth of** sowing is **1 cm** to ensure good even raising.
- The space **between rows** should be **15 cm at the most** to optimise the space and for easier weed control.



Appropriate soil preparation

Fine and crumbly on the surface

Pressed down in depth

Optimal density sow

Adapt the density to soil and climate conditions

Average density: 900 seeds/m^2

Shallow sow

1 cm is the ideal depth

The smallest space possible between the rows

Aim: <15 cm better space occupation

Reduction of the risk of soiling

Rolling just after sowing

Improved contact between the soil and the seed

Better germination

Easier harvesting (level soil without stones)

Monitoring of young seedlings

Slugs and insects (sitona weevils, etc.)

Weeding possible after the 3 trefoil phase

Sowing at the right intensity

- **Dense population on raising** fosters productivity and persistence of alfalfa for its planting period. The objective is to observe the raising of 800 seedlings/m² to reach a **density of 450 to 500 plants/m² after the first winter.**
- **Sowing density needs to be adapted to the region's climate and the soil type:** if the soil is healthy in the winter and if there is enough water in the summer, seed density can be reduced by 100 to 200 seeds/m². inversely, sowing density must be increased if the soil tends to be asphyxiating in the winter or in the case of very dry summers.

	Dry summer/ healthy winter	Dry summer/ humid winter	Humid summer/ healthy winter	Humid summer/ humid winter
Adaptation	++	+	+++	++
Recommended sowing density	900 seeds/m² 2 precidoses/ha	1000 seeds/m² 2.3 precidoses/ha	800 seeds/m² 1.8-60 precidoses/ha	900 seeds/m² 2 precidoses/ha

Key facts

PRÉCIDOSE®

MAS Seeds alfalfa is packaged in Précidose® units to guarantee a precise sowing density.

- Each Précidose contains **4.5 million seeds.**
- Sowing of **2 précidoses/ha** ensures optimal sowing density of 900 seeds/m².

Sowing at the right period

- Alfalfa can be sown in the spring or late summer, depending on the region's climate constraints.
- **Sowing in late summer** has the advantage of better establishing **the crop as** the taproot can develop during the winter. Alfalfa **can therefore be productive from the very first year of** planting. However, late summer sowing is only possible in regions where the **autumn is mild and humid**.
- In regions with a **cool autumn and early frost**, it is recommended to **sow in the spring** once the soil becomes warmer. Spring sowing is also preferred in regions where **late summer is very hot and dry** if the alfalfa is not irrigated.

Sowing alfalfa

Key facts

THE KEYS TO SUCCESSFUL SOWING

- CHOOSE THE RIGHT PLOT:
  pH>6.5 and not hydromorphic
- PREPARE THE SOIL WELL:
  fine soil on the surface while pressed down in depth to increase seed-soil contact
- SOW 1 CM DEEP and 15 cm between rows maximum
- SOWING DENSITY OF 900 GRAINES /M^2 to be adapted to the plot's conditions
- SOW AT THE RIGHT PERIOD:
  in the spring or in late summer, depending on the region

FERTILISING ALFALFA

As a leguminous plant, alfalfa does not require **any nitrogen inputs.** Its fertilisation is mainly focused on **phosphorus** and **potassium**, not forgetting **trace elements** and **maintaining the soil's pH**.

Phosphorus

- Alfalfa needs very high **bio-availability in phosphorus** to reach its yield potential**.** Phosphorus is also very important for the **development of roots** and the **persistence of the crop.** Alfalfa is a therefore highly dependent on phosphorus.
- Phosphorus-deficient alfalfa can be spotted by its purplish-blue colour on the leaves and purplish-red colour on the stem and under the leaves.
- **Alfalfa needs 60 to 70 kg of phosphorus/ha** on sowing then every year at the end of winter. This quantity needs to be adapted depending on the type of soil, the available phosphorus in the soil and what has been left in the soil from previous crops.

	Results of soil analysis		
Fertilisation history	Low in P	Average	Rich in P
Last input of P < = 2 years	40-60 kg/ha	30-40 kg/ha	0 kg/ha
Last input of P > 2 years	60-80 kg/ha	40-60 kg/ha	30-40 kg/ha

Source: Arvalis

Potassium

- In terms of quantity, **potassium is the most important element for growing** alfalfa. Potassium-balanced fertilisation **improves the productivity and persistence of** alfalfa. It also allows better storage of sugar in the tissues, which **strengthens plants' tolerance** to disease, cold and different types of stress.
- Potassium deficiency can be identified by yellow dots on both sides of alfalfa leaves.
- **Alfalfa needs 150 to 250 kg of potassium/ha**, to be modulated according to the level of productivity of the alfalfa, the type of soil, the rate of potassium available in the soil and what has been left in the soil from previous crops. It is recommended to fertilise during sowing and at the end of winter, preferably with **sulphur-potassium** forms and to fertilise in two applications in excess of 200 kg/ha.

Potassium deficiency

	Results of soil analysis		
Fertilisation history	**Low in K**	**Average**	**Rich in K**
Total restitution of the previous crop in the soil (leaves and stems)	100-150 kg/ha	60-100 kg/ha	0 kg/ha
No restitution of the previous crop in the soil or alfalfa > 1 year	200-250 kg/ha	100-150 kg/ha	60-100 kg/ha

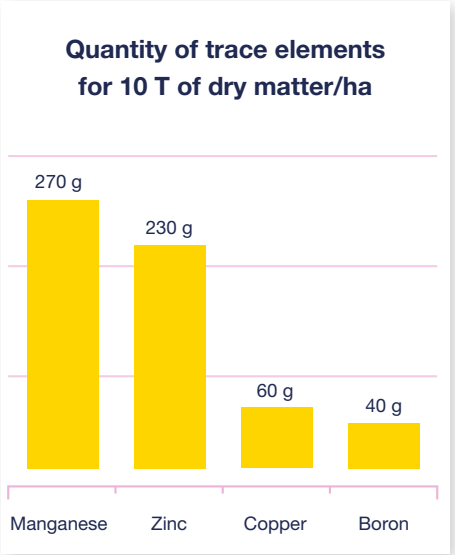
Source: Arvalis

Checking the soil's pH

- Although alfalfa can germinate with a very low pH, **the growth of seedlings is very limited in soil with a pH of less than 5.5**, intoxicated by aluminium made soluble in the soil. In addition, the development of rhizobium bacteria is very difficult in soil with a pH of less than 6, **therefore limiting the development of nodules.**
- In acid soil, it is important to **add lime** to target an **optimal pH of 6.5.**
- Attention, with a pH higher than 6.5, alfalfa could develop a **boron deficiency**.

Micro-element and trace element requirements

- **Sulphur:** alfalfa becomes pale green to yellow and its **protein content** can fall by up to 3 points in the case of sulphur-deficiency. It is recommended to add **50 to 100 kg/ha** in risk situations (soil that is filtering, superficial, low in organic matter, hydromorphic, etc.)
- Alfalfa is particularly sensitive to **magnesium, boron, copper and molybdenum deficiencies**. Fertilisation must be adapted to each case according to deficiencies detected in soil analysis. Alfalfa needs **50 kg/ha of magnesium, 500 g/ha of boron, 500 g/ha of copper and 100-300 g/ha of molybdenum.**



Source: Arvalis

IRRIGATING ALFALFA

Alfalfa is very resistant to drought thanks to its root system (taproot) which allows it to dig deep into the soil. But irrigation is needed in regions with low rainfall or in superficial soil.

Water requirements

Alfalfa's water requirements (ground water + rain + irrigation) are estimated to be **40 mm to produce 1T of dry matter.** It is therefore necessary to **adapt quantities to the yield objectives set**. Be careful: alfalfa does not like excessive water.

Plot of alfalfa irrigated by pivot

Irrigation management

Irrigation of alfalfa is closely linked to the frequency of mowing and the yield objective.

- **Every time the crop is mown:** irrigation **of 30 mm**
- **Between mowing:** irrigations of **20-25 mm** (1 to 4 according to the yield objective)
- **Stop irrigation:** at **the budding phase** to reduce lodging and loss of forage quality. Forage will also be drier to promote drying during swathing.

Key facts

MAS SEEDS ADVICE

- **Excessive irrigation** or **in excess of 50 mm** is not recommended.
- **Wait 3-4 days** after mowing to irrigate so that the alfalfa can gradually recover and avoid the effects of crusting.

CONTROLLING WEEDS

Alfalfa is a species that does not cope well with competition from weeds. It is important to keep the plot clean as soon as it is sown to optimise production and the persistence of the crop.

Reducing the negative impact of weeds before sowing

- **Long rotation** by alternating winter and spring crops can **reduce the development of weeds** in the plot before planting. Likewise, it is necessary to avoid growing alfalfa excessively in the same plot.
- **If the intercrop period is long enough** between harvesting of the previous crop and sowing of alfalfa, it is recommended to practise **non-selective chemical weed killing.** This will destroy a few hardy plants such as dock, which is difficult to destroy once alfalfa has been planted.
- If conditions are favourable, it is also recommended to **sow a stale seedbed** to raise weeds and destroy them before sowing. The stale seed bed is used to **destroy the stock of weeds** contained in the soil before planting alfalfa.

Weeds on the edge of the plot

Controlling the development of weeds as early as possible

- **The weeding strategy and doses to be used need to be calculated** according to the weeds present, the level of infestation of the plot and the progress of the alfalfa.
- The younger the weeds, the higher are the chances of success of the herbicide programme. It is also recommended to use **combined products** to reach the highest possible number of weeds **as early as possible.**
- **Alfalfa must be in a good vegetative** and growing phase to avoid the risk of phytotoxicity. It is also recommended to **apply herbicide on humid soil** for root products and in good **humidity conditions** for leaf products. Likewise, it is not recommended to apply herbicide if heavy rainfall or large temperature ranges are forecast in the coming days.
- Often, **a first early mow in the spring** can be enough to destroy a large proportion of weeds and **avoid use of chemical weed killer.**

Weeds when vegetation regrowth

Mechanical weeding

- **Mechanical weeding** is a good **way of supplementing chemical weeding** for certain weeds. The choice of equipment and depth of soil work needs to be calculated according to the age of the plot.

Equipment	Phase of the alfalfa	Observations
Spiked chain harrow	Vegetative rest Alfalfa > 6 months	1-4 cm deep Not very aggressive 2 opposite direction runs on unfrozen soil
Vibra shank cultivator	Vegetative rest Alfalfa > 1 year	5 cm Very aggressive 1 to 2 runs on frozen, dried out soil Finish with a spiked chain harrow
Heavy harrow	Vegetative rest Alfalfa > 1 year	5 cm Averagely aggressive 1 to 2 runs on frozen, dried out soil Finish with a spiked chain harrow

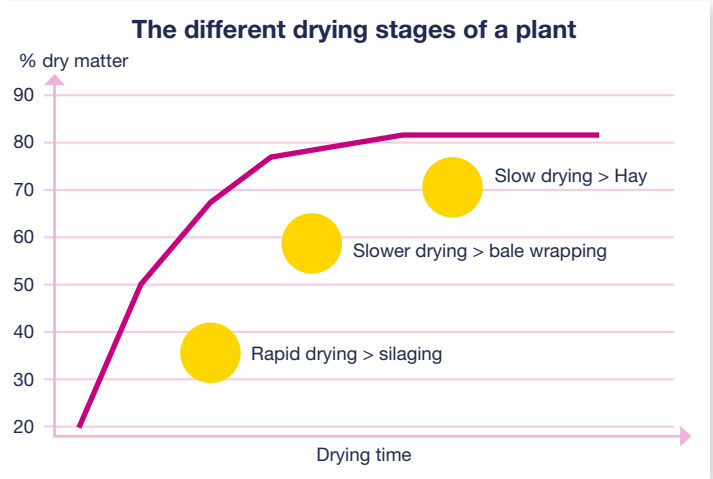
Source: Arvalis

HARVESTING ALFALFA

There are several issues in the harvesting phase: **ensuring the quality of forage** harvested without damaging the alfalfa in order to **maintain its persistence.**

Defining the harvesting method

- According to the objective of the farmer and the weather conditions, alfalfa can be harvested by **silaging, bale wrapping or for hay.**
- Usually farmers prefer **silaging for the first mow** of the year when the drying time on the ground is limited and **hay or bale wrapping in the summer.**



Source: internal to MAS Seeds

		Harvesting recommendations	Benefits	Drawbacks
	**Silaging**	• % of dry matter ideal for storage: 35% • drying in the field: 1 to 2 days	• Excellent nutritional value • Not very dependent on climatic conditions • Loses few leaves during harvesting	• Difficult to store • Needs a silo adapted to the size of the herd
	**Bale wrapping**	• % of dry matter ideal for storage: 55% • Drying in the field: 2 to 4 days	• Not very dependent on climatic conditions • Easy to store • Loses few leaves during harvesting	• Very costly
	**Hay**	• % of dry matter ideal for storage: 85% • drying in the field: 4 to 6 days	• Low cost • Excellent hay	• High risk of loss of leaves during harvesting and during storage • Very dependent on climatic conditions

Source: internal to MAS Seeds

Define mowing stage

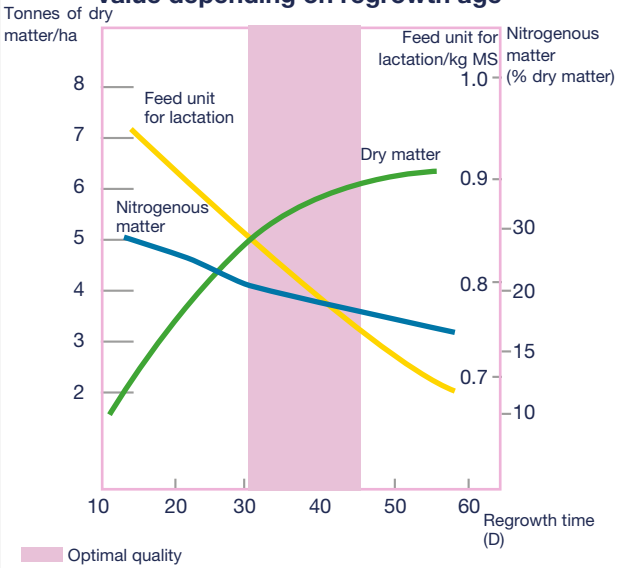
- The mowing stage **depends on the farmer's objective**. Between the start of budding and the start of flowering, **the dry matter yield** increases whereas **nutritional values** (protein and digestibility) decline.

- If the farmer is looking for **protein-rich forage**, it is recommended to cut the alfalfa as early as possible in the **start of budding phase** (good balance between yield and protein value).

- If the farmer is looking for **volume** or wants to make high quality hay, it is recommended to mow **at the start of flowering phase** (optimised yield).

- In all cases, it is not recommended to mow after the start of the flowering phase. The **nutritional value drastically falls after flowering** while the yield becomes stable.

Evolution of the yield and nutritional value depending on regrowth age



Source: INRA 2010 tables

Start of budding	Budding	Start of flowering
Quality	Quality/yield	Thermal efficiency

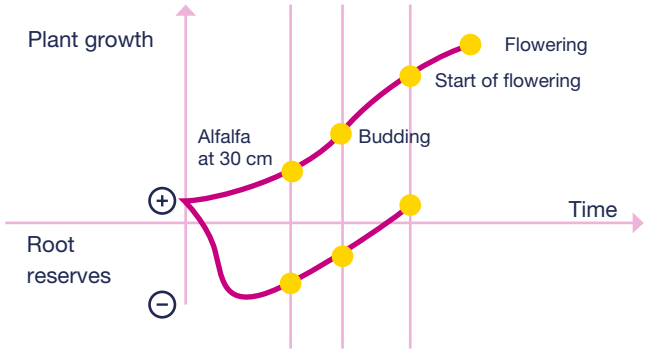
Mowing stage depending on objective

Best mowing practices

- **Cut to 6 to 7 cm high**
  Any lower and there is a **risk of damaging the buds of the future stems**, which slows down regrowth between each mow and damages the **persistence of the crop**. Also, cutting too low can increase the risk of damaging equipment and of harvesting soil in the forage. However, mowing too high (above 7 cm) **reduces the yield**.

- **Let the alfalfa flower once a year**
  At the flowering phase, all the nutrients descend from the leafy parts into the roots **to stock up for the taproot**. **Letting the alfalfa flower once a year** (on one of the last mows of the year) is indispensable **to maintain the persistence of the alfalfa.**

Evolution of growth and root reserves on first growth or after mowing (according to DEMARLY)



Source: ARVALIS

- **Mow in the morning**
  Mowing in the morning ensures **a whole day of drying**, to maintain the **forage quality**. Be careful however not to mow in humid conditions so as not to compact the soil and impact the persistence of the alfalfa (reduced gas exchanges around the roots).

- **Frequency of mowing**
  Respect **a frequency of 3 to 4 weeks** to allow the alfalfa to regenerate between mows and maintain **persistence** of the crop.

- **The last mow should be at least 4 weeks before the first frost**
  The last mow of the year should be done at least **3 to 4 weeks before the first frost** to let the alfalfa reach a sufficiently advanced stage to face the winter and **ensure a good restart** the following spring.

Key facts

THE KEYS TO SUCCESSFUL HARVESTING

- **CHOOSE A HARVESTING METHOD** adapted to the period's drying conditions.
- **DEFINE THE MOWING STAGE** depending on the farmer's objective.
- **CUT TO 7CM** to maintain the alfalfa's persistence.
- **LET THE ALFALFA FLOWER** once a year to allow root renewal.
- **SPACE OUT MOWING TIMES** by at least 3 to 4 weeks and mow for the last time 4 weeks before the first frost.

DISEASES AND PESTS

Source: internal to M.S Seeds

The main diseases affecting alfalfa

The main pests affecting alfalfa

THE MAIN DISEASES AFFECTING ALFALFA

Verticilliosis

- Verticilliosis is the most frequently found disease **in Northern and Eastern Europe.**
- It is a fungus **stored in plant debris and the soil. It penetrates via the taproot.** Attacks intensify with the number of mows and as the years go by. Verticilliosis **impacts the yield and persistence of the crop**
- The symptoms are **yellowing of the central rib** and **drying of the leaves.** The plant turns yellow, shortens and dries slowly while remaining erect. The **browning of the vascular ring of the stem is observed.**
- There is no **fungicide treatment** for verticilliosis. The only ways to fight the disease are to **choose varieties that are tolerant to disease** and take care of planting the alfalfa in risk zones.

Symptoms of verticilliosis on the leaves

Symptoms of verticilliosis on the vascular ring

Anthracnose

- Anthracnose is the most commonly found disease in **Southwest Europe** (Spain, southern France).
- The fungus **is stored in the form of mycelium** in plant debris or in the tissues of affected plants.
- **Beige to light grey lesions with brown edges** appear **at the base of the stem**. These lesions are **diamond-shaped and measure around 1 cm.** The leaves become yellow and wither while the stem dries and curls up.
- **The selection of tolerance varieties** is the best way to fight anthracnose. **An early mow** also limits the development of the disease on the following regrowths.

Symptoms of anthracnose on the stems

Symptoms of anthracnose on the leaves

THE MAIN DISEASES AFFECTING ALFALFA

Purple rhizoctonia

- Purple rhizoctonia is the leading alfalfa disease in **Italy** and **Romania**.
- The fungus **can stay for years in the soil** thanks to its **sclerotia**.
- The disease **develops in clusters** in the plot. Infested plants become yellow, wither and die. A **purple sleeve is observed on the crown and taproot.**
- There is no effective treatment; alfalfa is particularly sensitive to this disease. **Long crop rotations help clean the soil**, however purple rhizoctonia also attacks other crops such as potato, carrot and beet.

Symptoms of purple rhizoctonia on the crown and taproot

Pseudopeziza

- Pseudopeziza is the second most frequently found disease in **Eastern Europe.**
- The fungus **develops within tiny black spores on the leaf's surface.** The spores die when the leaves dry. Development intensifies in the spring and autumn when the **weather is cool and humid.**
- **small black dots** (spores) appear on both sides of the leaves. **The plant loses a large number of leaves**, however there are very few symptoms on the stem.
- There is **no** treatment against pseudopeziza. **Early mowing** is the best way of stopping the development of the disease.

Source: luzerne.org

Symptoms of pseudopeziza on the leaves

THE MAIN DISEASES AFFECTING ALFALFA

Sickness	Type	Symptoms	Photos
Verticilliosis	Root and crown disease	- Leaves: the central rib becomes yellow and the leaflets dry up. - Plants: become yellow and dwindle, remain erect, wither gradually and die. - Stems: the vascular ring turns brown, the inter-node space becomes shorter, difficulty growing.	
Purple rhizoctonia	Root and crown disease	- The disease develops in clusters in the plot. - Plants: wither, turn yellow and die. - Tap root and crown: surrounded by a grainy purple sleeve. The bark is invaded by the fungus and dries up.	
Anthracnose	Disease affecting the stems and leaves	- Lesions appear at the base of the stem: 1 cm long, diamond-shaped, beige edged with brown. - The stem stays green while the leaves turn yellow and wither. - Finally the stem dries out and curls at the top.	
Pseudopeziza	Disease affecting the stems and leaves	- On both sides of the leaves: small brown spots (0.5 to 2 mm). - Plant: in the case of a severe attack, spots are found on the stalks and stems. - Many leaves lost.	

Source: luzerne.org

THE MAIN PESTS AFFECTING ALFALFA

Nematodes

- Nematodes **are small worms that are invisible to the naked eye.** They **develop in the roots and stems** of alfalfa. They are found in seeds and plant debris.
- Nematodes **develop in clusters** which can reach several metres in the plot. Infested plants show **swelling on the crown and stem. The leaves swell** and become misshapen. Spaces between the nodes become shorter **and the plant dwindles**. An attack at the young stage of the plant leads to the death of the crop.
- There is **no treatment** against nematodes. The best way of fighting them is to choose **resistant varieties** and use **certified seeds** to avoid contamination. **Long crop rotations** are also used to limit the development of nematodes.


Source: internal to MAS Seeds


Source: internal to MAS Seeds

Dodder

- Dodder **is a non-chlorophyll-producing parasitic plant.** Its filaments have suckers which directly tap into alfalfa's nutritive elements. It **rapidly develops in clusters** that form large circles in plots. **Yellow filaments** rapidly spread through the crop and suffocate the plants.
- Dodder is **very prolific** due to **abundant production of seeds**, which **can survive 40 years** in good storage conditions. Agricultural machinery and the production of farm seeds favour the dissemination of seeds across plots.
- The fight against dodder starts **by choosing certified seeds** to avoid contamination by seeds. In case of the appearance of a cluster, it is important to **rapidly apply chemicals in the zone.** Only the **destruction of the host plant** allows the eradication of dodder. As a precaution, application zones must overlap the cluster by 2 or 3 metres.


Source: internal to MAS Seeds


Source: internal to MAS Seeds

Key facts

- Sowing **certified seeds** is the best protection against dodder.
- **MAS Seeds alfalfa seeds are certified to have 0% dodder in the bags.**

Pest	Type	Symptoms	Photos
Nematodes	Worms	- Develop in clusters. - Small invisible worms. - The base becomes swollen with swelling of the crown. - The stem thickens and inter-node spaces become shorter. - The leaves become swollen and misshapen. Causes the death of young plants.	
Dodder	Parasitic plant	- Non-chlorophyll-producing parasitic plant - Takes nutritive elements directly from alfalfa. - Creates large circles in plots. Dodder asphyxiates alfalfa. - The only way to fight dodder is to destroy the host plant by chemical treatment 2 to 3 metres around the circles.	
Apion	Small blue weevil, 2-3 mm	- Larvae: eat the insides of buds during the winter. Delay vegetation in the spring. - Adults: make small holes in the leaves in the spring. Do not cause major damage. - Mowing in the winter can be enough to eliminate the larvae.	
Sitona weevils	Grey wevill, 5-6 mm	- Larvae: develop in the nodules in the spring. Disturb the plant's nitrogen intake. Can attack the taproot. - Adults: appear in late July. Eat the leaf contour. Major damage to young plants. - Watch out for infestation on germination and apply chemical treatments if necessary.	
Alfalfa weevil	Brown wevill, 4-6 mm	- Larvae: green with a white line on the back. Major damage on the upper part of the plants. - Adults: do not live on the alfalfa, only appear in the autumn to lay eggs. - Chemical treatment to destroy the larvae.	

Source: luzerne.org

Notes

Notes

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